Report from the Airplane Performance Harmonization Working Group

Issue: Additional Vertical Obstacle Clearance When Bank Angle Exceeds 15°

Rule Section: FAR 121.189, FAR 135.379 / JAR-OPS 1.495

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

It is fundamental to operational safety that the pilot should be able to safely complete a takeoff and clear all obstacles beyond the runway end, even if power is lost from the most critical engine just before the airplane reaches a defined go/no-go point. This principle has formed the basis of the takeoff performance standards required for the type certification and operation of turbine engine powered transport category airplanes since Special Civil Air Regulation No. SR-422, effective August 27, 1957. As of March 20, 1997, the application of this principle was extended by the "commuter rule" to also cover scheduled passenger-carrying operations conducted in airplanes that have a passenger seat configuration of 10 to 30 passengers and turbojet airplanes regardless of seating configuration.

The takeoff performance standards specify both horizontal and vertical obstacle clearance requirements. Meeting the vertical obstacle clearance requirements can, in some cases, result in significant payload penalties, especially when mountainous terrain is a factor. An operator faced with such payload penalties will often develop a special turning departure procedure that avoids over-flight of the limiting obstacles. In rare cases, the bank angle required to avoid over-flight of the limiting obstacles exceeds 15°. (The airplane must still meet the vertical obstacle clearance requirements for the obstacles under the turning flight path.)

The net takeoff flight path data in the Airplane Flight Manual is based on the lowest part of the airplane with zero (no) bank and accommodates bank angles up to 15°. When bank angles exceed 15°, the lowest part of the airplane may be lower than that used in the definition of the net takeoff flight path data. In order to maintain the 35 foot vertical obstacle clearance required by the takeoff performance standards in such cases, the net takeoff flight path must clear obstacles vertically by an additional amount.

2 - What are the current FAR and JAR standards relative to this subject? [Reproduce the FAR and JAR rules text as indicated below.]

Current FAR text:

FAR 121 and FAR 135 do not specifically address this issue.

Current JAR text:

JAR-OPS 1.495 Take-off Obstacle Clearance

(c) When showing compliance with subparagraph (a) above:

(2) Any part of the net take-off flight path in which the aeroplane is banked by more than 15° must clear all obstacles within the horizontal distances specified in subparagraphs (a), (d) and (e) of this paragraph by a vertical distance of at least 50 ft, and

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed? [Reproduce text from issue papers, special conditions, policy, certification action items, etc., that have been used relative to this issue]

Historically, FAA operators have obtained special approval for all turn procedures that require bank angles in excess of 15°. Additional vertical clearance requirements have been addressed on an as-needed basis, although perhaps with more flexibility than would be permitted under the proposed rule. However, since the vast majority of such procedures are designed to avoid obstacles laterally, the result is that additional vertical clearance has rarely, if ever, been required.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in? [Explain the differences in the standards or policy, and what these differences result in relative to (as applicable) design features/capability, safety margins, cost, stringency, etc.]

The FAA takeoff performance standards do not specifically address the issue; however, FAA policy has been to grant special approvals for departure procedures requiring bank angles in excess of 15°. The special approval process has included an evaluation of the impact of increased bank angles on vertical obstacle clearance.

The JAA standards require an additional 15 foot vertical obstacle clearance requirement (total vertical clearance of 50 feet) for the portion of the net takeoff flight path where the bank angle exceeds 15°.

While the JAA standard requires a fixed amount of additional vertical obstacle clearance, which may be more than is actually needed in some cases, there is no significant difference in the level of safety provided by these different policies.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

The differences in compliance are due to the differences in standards and/or policy. The FAA does not require an additional vertical obstacle clearance margin if analysis shows

that it is not necessary. The JAR, on the other hand, requires a fixed additional margin all the time.

5 – What is the proposed action? [Describe the new proposed requirement, or the proposed change to the existing requirement, as applicable. Is the proposed action to introduce a new standard, or to take some other action? Explain what action is being proposed (not the regulatory text, but the underlying rationale) and why that direction was chosen for each proposed action.]

The Performance Harmonization Working Group proposes to harmonize on a modified version of the JAR. Both standards would require an operator to address the additional vertical obstacle clearance issue by conducting an analysis to determine whether the increased bank angle results in the lowest part of the airplane being lower than that used for the establishment of the net takeoff flight path and, if so, using the lowest part of the banked airplane for showing vertical obstacle clearance.

For the FAA, this would codify and standardize what has historically been addressed through special approvals.

For the JAA, this would allow flexibility while maintaining an adequate safety margin.

For each proposed change from the existing standard, answer the following questions:

6 - What should the harmonized standard be? [Insert the proposed text of the harmonized standard here]

FAR text

FAR 121.189 Airplanes: Turbine Engine Powered: Takeoff Limitations

Add the following:

(i) When a bank angle of more than 15 degrees is used to show compliance with paragraph (d)(2) of this section, the vertical obstacle clearance requirement for that portion of the net flight path in which the bank angle is greater than 15 degrees shall be at least 35 ft relative to a net takeoff flight path corresponding to the lowest part of the banked airplane.

FAR 135.379 Large Transport Category Airplanes: Turbine Engine Powered: Takeoff Limitations.

Add the following:

(i) When a bank angle of more than 15 degrees is used to show compliance with paragraph (d)(2) of this section, the vertical obstacle clearance requirement for that portion of the net flight path in which the bank angle is greater than 15 degrees shall be at least 35 ft relative to a net takeoff flight path corresponding to the lowest part of the banked airplane.

JAR text

JAR-OPS 1.495 Take-off Obstacle Clearance

(c) When showing compliance with subparagraph (a) above:

(2) Any part of the net take-off flight path in which the aeroplane is banked by more than 15° must clear all obstacles within the horizontal distances specified in subparagraphs (a), (d) and (e) of this paragraph by a vertical distance of at least 35 feet relative to the lowest part of the banked aeroplane, and

Summary of Changes:

1) Add sections 121.195(i) and 135.379(i).

2) In JAR-OPS 1.495(c)(2), replace "50 feet" with "35 feet relative to the lowest part of the banked aeroplane."

7 - How does this proposed standard address the underlying safety issue (identified under #1)? [Explain how the proposed standard ensures that the underlying safety issue is taken care of.]

The proposal would require operators to ensure that the net takeoff flight path meets the 35 foot vertical obstacle clearance requirement at all times, even when the airplane is banked more than 15 degrees.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. [Explain how each element of the proposed change to the standards affects the level of safety relative to the current FAR. It is possible that some portions of the proposal may reduce the level of safety even though the proposal as a whole may increase the level of safety.]

The proposal maintains the existing level of safety. It simply codifies what has historically been addressed through special approvals.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. [Since industry practice may be different than what is required by the FAR (e.g., general industry practice may be more restrictive), explain how each element of the proposed change to the standards affects the level of safety relative to current industry practice. Explain whether current industry practice is in compliance with the proposed standard.]

See item #8.

10 - What other options have been considered and why were they not selected? [Explain what other options were considered, and why they were not selected (e.g., cost/benefit, unacceptable decrease in the level of safety, lack of consensus, etc.) Include the pros and cons associated with each alternative.]

Since the policies and practices used in both the FAA and JAA environments already address the issue, no other alternatives were explored.

11 - Who would be affected by the proposed change? [Identify the parties that would be materially affected by the rule change – airplane manufacturers, airplane operators, etc.]

Operators who currently hold special FAA approvals for increased bank angles may be affected in that they would be expected to show compliance specifically in accordance with retaining a 35 foot margin from the net flight path corresponding to the lowest part of the banked airplane.

Airplane manufacturers may be affected. The analysis to determine the lowest part of a banked airplane can be very complex. The airplane has a positive pitch angle, is banked, and is subject to aerodynamic loads that cause wing bending. The data required to conduct such an analysis is generally not available to airplane operators; therefore, it may be necessary for airplane manufacturers to provide acceptable data for their respective models, for those cases where a simple geometric analysis is not acceptable.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

N/A

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted? [Indicate whether the existing advisory material (if any) is adequate. If the current advisory material is not adequate, indicate whether the existing material should be revised, or new material provided. Also, either insert the text of the proposed advisory material here, or summarize the information it will contain, and indicate what form it will be in (e.g., Advisory Circular, policy, Order, etc.)]

As stated in item 11 above, the analysis to determine the lowest part of a banked airplane can be very complex. This is especially true for large airplanes with low wings and wing-

mounted engines. On the other hand, airplanes with short wingspans, relatively stiff wings and/or high mounted wings may require nothing more than a simple geometric analysis.

Guidance material should be developed indicating the conditions under which a simple analysis is adequate and the items that should be considered when undertaking a more detailed analysis.

14 - How does the proposed standard compare to the current ICAO standard? [Indicate whether the proposed standard complies with or does not comply with the applicable ICAO standards (if any)]

The relevant ICAO standards for the "Operation of Aircraft" (Annex 6) require that obstacles be cleared horizontally and vertically by an adequate amount. This proposal is in compliance with that general requirement

15. – Does the proposed standard affect other HWG's? [Indicate whether the proposed standard should be reviewed by other harmonization working groups and why.]

No.

16 - What is the cost impact of complying with the proposed standard? [Please provide information that will assist in estimating the change in cost (either positive or negative) of the proposed rule. For example, if new tests or designs are required, what is known with respect to the testing or engineering costs? If new equipment is required, what can be reported relative to purchase, installation, and maintenance costs? In contrast, if the proposed rule relieves industry of testing or other costs, please provide any known estimate of costs.]

The major cost of complying will be to produce acceptable data by the airplane manufacturers. The cost to operators is expected to be negligible.

17. - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

N/A

18. – Does the HWG wish to answer any supplementary questions specific to this project? [If the HWG can think of customized questions or concerns relevant to this project, please present the questions and the HWG answers and comments here.]

No.

19. – Does the HWG want to review the draft NPRM prior to publication in the Federal Register?

Yes.